Telecommunications Planning in the SCAG Region

Southern California Association of Governments
Transportation Department

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TELECOMMUNICATIONS PLANNING

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> "No less than planning for transportation, commercial development, or public services, planning for communications in an 'information age' deserves the serious consideration of California's cities.
>
> Without planning, cities may find themselves handicapped by haphazard communications infrastructures as burdensome as was the crazy stitchery of toll roads to an earlier era.
>
> With planning, cities can translate a rich array of communications technologies and services into a thriving urban economy and culture."
>
> - Robert Jacobson, "Planning a Communications Infrastructure," Western City, July, 1983.

1. Introduction

Public-sector telecommunications planning currently exists at federal, state, and local levels. It is practically nonexistent at the regional level. The Southern California Association of Governments is one of the first regional planning agencies to recognize the need for comprehensive regionwide telecommunications planning, and to begin incorporating telecommunications into its planning structure. This report outlines the initial efforts toward telecommunications planning at SCAG, and the direction such efforts are expected to take in the near future.

By all accounts, the character of our economy is in transition. The Industrial Revolution of the last century is giving way to the Information Revolution of this one and the next. The former preeminence of the manufacturing sector of the economy is being replaced by information-driven sectors: financial, insurance, government. Parallel to the explosion of information generation have been the enormous advances in information organization, storage, and dissemination, especially by electronic means. Thus, the Information Revolution is intimately entwined with the Telecommunications Revolution. We can expect the changes taking place ultimately to affect our collective lives as radically as the shift from an agricultural economy to an industrial one, and to affect our individual lives as radically as the invention of the automobile.

The impacts of the Telecommunications Revolution have been, and will continue to be, felt nowhere more than in Southern California. The presence of the television, cable television, and motion picture industries; the concentrations of electronics research, development and

manufacturing industries in Orange County and the Los Angeles International Airport area; and a relatively affluent and acquisitive lifestyle all combine to make Southern California unique in development, marketing, and utilization of telecommunications technology.

While the telecommunications revolution has enormous potential, this potential is only slowly being realized. Technological, institutional, interpersonal, managerial, political, regulatory, legal, educational, and financial problems are numerous. For example:

- Hardware from different systems are often incompatible; the same is true of software.
- Installation of new cable systems is often characterized by residents' complaints about construction; completed systems are often characterized by serious lapses of service and failure adequately to address consumer complaints.
- Many policymakers lack familiarity with the important issues in telecommunications decision-making.
- Since the cable franchising process takes place at a local level, adjacent jurisdictions may differ widely in their franchise agreements.
- There is usually no impetus for the interconnection of separate cable franchises.
- Television, the movie industry, cable, microwave, satellite, and telephone have overlapping markets, but are competing to offer similar services under different regulatory structures.
- Lack of awareness and training on the part of the general public, and lack of commitment on the part of the cable operator and/or franchising authority, means that public access channels are often not used to the greatest extent possible.
- Economic and institutional barriers have prevented two-way services such as shopping, banking, electronic mail, and alarm systems from being used on a wide scale as yet.
- Telecommunications planning and administration in both public and private sector organizations is typically splintered, with entirely different departments having responsibility for data management, telephone equipment, video equipment, and (in municipal governments) cable franchise administration.
- The shift away from industrial/manufacturing sectors to information/service sectors of the economy is permanently eliminating many jobs, and presents a major challenge in terms of job retraining.
- There is a danger that the ability and means to access and exploit the huge amounts of information becoming available via

telecommunications will be concentrated in the upper classes of our society, further widening the social, economic, and power gap between the "haves" and the "have-nots."

These are some of the major shortcomings of the current telecommunications environment. Most, if not all, of the problems listed above are symptoms of the inevitable disorganization found in the early stages of any sweeping technological/sociological change; similar kinds of problems have accompanied previous radical advances such as the telephone and the automobile. Thus, solutions of some kind will doubtless appear with time. However, solutions that are left to appear of their own accord will probably not be the best answers. The full potential of telecommunications technology will be achieved only as solutions to the difficulties which arise are actively designed, with cooperation between the public and private sectors. This argues the need for telecommunications planning to some extent at all levels of government, for explicit recognition and support in the private sector of the positive public implications of the telecommunications revolution, and for an informed, intelligent public-private liaison.

The following section describes the need for region-level telecommunications planning. The third section focuses on an important aspect of the telecommunications revolution, namely the transportation-telecommunications tradeoff, and presents the preliminary results of an analysis begun at SCAG this year. The final section discusses possible future directions telecommunications planning at SCAG will take, both in the near term and in the long term.

2. The Need for Regional Telecommunications Planning

If telecommunications policy is being addressed at federal, state, and local levels, what is the need for policy-making at the regional level? In broad terms, the argument for regional telecommunications planning is the same argument for any regional planning: the state level is too far removed from the concerns of any one region and lacks the resources to give each region the detailed attention it requires, while the local level has too narrow a perspective and is apt to favor its own interests at the expense of the region. Intermediate-level planning recognizes the region as a functional whole, albeit composed of autonomous local jurisdictions, and works to promote regional interests. Regional planning provides an infrastructure for addressing truly regional issues: formal and informal contacts across jurisdictional boundaries; provision of a forum for discussion, analysis, and resolution of regional issues; professional and technical expertise in planning and analysis; coordination of similar problems and situations throughout the region; and provision of a clearinghouse for information exchange.

Thus, telecommunications in the abstract is a regional planning issue in the same league as housing, water, air quality, transportation, and waste management. As with each of these other issues, local policies and problems have a regional impact, and therefore, need to be reviewed from a regional perspective. Further, there are significant benefits to be derived from coordinated management; pooling resources and

eliminating useless duplications may permit more effective utilization than any single jurisdiction could achieve alone.

In specific terms, however, there are two aspects of telecommunications which are of regional import. First, telecommunications is of enormous public value, naturally, as a means of communication throughout the region. Regional broadcasting has long been possible with conventional radio and television, but the increasing availability of additional telecommunications technology is leading to an infrastructure whose capacity, flexibility, and universality will make possible an entirely new dimension of public communication and public sector planning. For example, cable television can have very large channel capacity (over 100 channels in the state-of-the-art plants), interactive capability (i.e., the ability to send signals from a household or institution as well as receive them), and addressability (i.e., the ability to selectively send signals, or "narrowcast," to any specified subset of subscribers). With these characteristics, the potential exists for the pervasive use of cable in public communications areas such as institutional seminars and job-training programs, educational courses, public hearings, emergency procedures, legislative and planning activities, and information exchange. As for public sector planning, the proliferation of microcomputers and the connection of those micros to mainframes, to other micros, and to professional information networks will (as in the private sector) enormously facilitate the sharing of information within and between public sector planning agencies at all levels of government and in all parts of the country.

As argued before, however, these fascinating possibilities will not necessarily evolve of their own accord. It takes a certain amount of effort to get computers to physically communicate with each other, and an ongoing commitment to coordination to be able to make effective use of the increased availability of information. As for cable television, its usefulness in regional public sector communications is hamstrung unless cable systems throughout the region are interconnected. Otherwise, programming is effectively limited to retransmission of conventional broadcast signals, national satellite networks, and strictly local productions; use of the interactive and addressability characteristics of cable (e.g., in teleconferencing or data transmission over institutional networks) is restricted to cable franchise boundaries. While interconnection is certainly technologically feasible, and is in fact commonplace in some metropolitan areas, there remain certain technical, financial, and institutional barriers to its implementation in Southern California. The need for some direction and coordination at the regional level is clear.

The second aspect of telecommunications which is of concern to regional planning is its ability to substitute for travel. The need for person travel very often derives simply from the need to communicate some kind of information, such as data, ideas, or formal documents. With the telecommunications revolution, it is becoming increasingly easy to accurately and cost-effectively transport the information directly, without transporting the person as well. There are several different kinds of trips which are well suited to telecommunications

substitution:

a. The Interregional Business Trip. Teleconferencing, or the simultaneous interaction of people who are physically separated, is becoming increasingly common, thus reducing the need for travel to a central meeting place. Technology ranges from the simple telephone conference call, to computer teleconferencing exchanging messages and data, to elaborate videoconferencing techniques capable of transmitting images of people and graphics.

b. The Work Trip. Work trips form the largest single trip category. Their predominance and their peaking characteristics make them the most critical kind of trip to deal with so far as providing adequate transportation facilities in the region. In terms of telecommunications substitution, people whose jobs now involve or could involve telecommunications technology such as computers and word processors will often be able to work at home, avoiding a trip during peak hours. Working at home is also an option for many others whose jobs may not directly involve telecommunications devices (except possibly the telephone)--jobs containing such elements as keypunching, typing, other clerical work, thinking, writing, and research. Another alternative which has received some attention is the concept of neighborhood work centers, in which clerical jobs such as word and data processing are performed in small centers located close to residential areas rather than in a central business district. The neighborhood center may be a satellite of a single large corporation, or it may lease facilities to a number of organizations.

c. The Education Trip. Cable television provides the ability to "attend" lectures at home, on the job, or at some other location. With a video recorder, the lectures can be taped and played back at a convenient time. With the increasing use of interactive cable TV, it will be possible for the "remote" student to ask questions and participate in class discussions.

d. Entertainment, Shopping, Banking Trips. Television, cable TV, video players and games, and the personal computer can all be sources of home entertainment, thereby substituting for travel to a theater or to some other form of entertainment. Finally, interactive cable TV can allow for shopping (e.g., grocery and catalog) and banking (e.g., payment of bills, transfer of funds) to be done at home.

The prospect of widespread trip substitution via telecommunications raises a host of questions about the short- and long-term effects of such substitution on the urban form (residential, shopping, and employment locations, the transportation system), and about derivative effects of travel changes on air quality and energy consumption. Analyzing, shaping, and planning for these effects is of vital importance to the health of the region. Some of these issues will be raised in the following section, in which preliminary results from a study of telecommunications substitution for work trips in the SCAG region are presented.

3. Telecommunications Substitution for Travel

3.1 Introduction

In the fall of 1982, the SCAG Executive Committee approved changing the name of the Transportation and Utilities Committee to Transportation and Communications Committee. Including communications issues for the first time as an appropriate area of study within a SCAG policy advisory committee reflects the feeling of the Executive Committee that the radical advances in communications technology which are taking place will produce major new issues and changes in regional planning. Including communications in the same committee as transportation, and giving major responsibility for telecommunications planning at SCAG to the Transportation Planning Department, reflects the concept that transportation and communications are intimately related.

The previous section described the nature of that relationship, and outlined several kinds of trips which are particularly suited to telecommunications substitution: interregional business, work, education, shopping, banking, and entertainment. It is important (a) to identify the future extent of telecommunications substitution for such trips, and (b) to analyze the effect that substitution will have on the transportation system. How will trip substitution vary with trip purpose, with time (as the market matures), with geographical location, with mode (transit versus shared ride versus auto driver), with sociodemographic profile (age, gender, profession)? Will substitution be extensive enough to significantly reduce congestion on major highways or transit patronage in the region? What will be the long-term impacts on residential and employment location, and on the form of urban shopping centers? Will there be less need for highway and transit investments due to telecommunications substitution? Or will the ability to substitute actually result in increased travel--in the short run either directly because the demand for face-to-face interaction is stimulated by telecommunications interaction, or indirectly because the increased time and flexibility available will lead to other trips being made instead of the work trip--or in the long run because of decentralization of residential and job location? What will be the eventual impact on air travel demand?

As important as these questions are, they cannot all be addressed at once. In narrowing its focus to a manageable level, SCAG has decided initially to address the substitution potential of the work trip alone. There are several reasons for this. First, work is by far the most frequent trip purpose, accounting for about 27% of intraregional travel in the SCAG region. Further, work trips tend to be longer than other trips. Second, most work trips occur at the same times of day, thereby causing peak loading on the transportation system and contributing disproportionately heavily to congestion and pollution in the region. Finally, the frequency and regularity of the work trip (e.g., the destination is usually the same every day) make it easier to study than the other trip purposes listed above. While much has been written about the telecommunications applications for the other purposes, very little has been done (with the exception of the intercity travel/

teleconferencing tradeoff) in terms of analyzing travel substitutability for each purpose.

In the following subsection, then, telecommunications substitution for the work trip, or "telecommuting", is discussed. In section 3.2.1, some case studies are briefly mentioned, followed by some remarks on estimating substitution. Section 3.2.2 deals with analysis of the effect of substitution on the transportation system, and presents results from a preliminary study performed at SCAG this year.

3.2 Telecommunications Substitution for the Work Trip

3.2.1 Identifying the Extent of Telecommuting

Consider the following examples, taken more or less verbatim from AQMP Appendix VIII-B (1982), Olson (1981), and Krause (1981):

- Freight Data Systems--Inglewood, California

  Freight Data Systems is a small service company which provides a data base of freight rates to shippers. During 1981, this company grew rapidly from 3 to 12 employees. Since Freight Data could not expand its office space, it either had to move to costlier quarters or find another alternative.

  The president decided to have his employees telecommute. The company paid to have computers, which included features such as word processing, installed in its employees' homes. Although there was an initial capital cost for the computer equipment, it was partially recovered since the workers no longer used their company cars for commuting to the office. In place of an office manager to supervise the work flow, a bonus was paid to those employees who finished their work ahead of schedule. The company president claimed that increased productivity paid for its computer investment within five months.

- Security Pacific National Bank--Los Angeles, California

  This large bank is now experimenting with telecommunications and telecommuting. There are presently about 20 employees who have computer terminals in their homes. Most employees working at home are managers and professionals, but Security may expand the program to include other types of employees. It is reported that the Vice President of Security's Office Automation Products department believes that as many as 2000 workers will have home terminals in five years.

- ARCO--Los Angeles, California

  ARCO is considering the installation of 8 to 10 computer word processors in the homes of its employees, although these workers will still do most of their work in the central office. These are professionals and ARCO has no plans at present to study use of telecommuting by clerical staff. ARCO management believes that the

greatest gain in productivity will come from professionals rather than clerical workers. However, ARCO has put word processors in the homes of two clerical workers on sick leave, and in the home of a speechwriter. ARCO management appears to be willing to try out telecommuting on a limited basis, but wants to explore the parameters more before implementing a program.

- o U.S. Control Data Corporation--Minneapolis, Minnesota, and Sunnyvale, California

The program started as a voluntary work-at-home pilot project with 60 managerial and professional employees. The company plans to expand its program to clerical employees.

- o Heights Information Technology Service--Tarrytown, New York and Oakland, California

Heights is a software contract firm. The firm subcontracts work to "panel members," data processing professionals who, for one reason or another, have chosen not to be members of the full-time work force. The majority of panel members are women with primary child-care responsibility; however, forty percent are men. The company was started in 1978 under management contract with F International, a firm in England that has utilized the work-at-home concept successfully for over eighteen years.

Panel members work part time or full time for short periods, based on the availability of projects and skills required for each. Each project is assigned a project manager who is the primary liaison between the client and other panel members. Panel members may bill for work on the basis of a fixed price, piece rate (e.g., per program), or time and materials, depending on the situation. Although most fit work around family or other commitments, they tend to work a fixed number of hours per week. All projects are estimated on the basis of two-week deliverables that can be negotiated to meet the panel member's schedule.

- o Blue Cross/Blue Shield of South Carolina

For two years, Blue Cross/Blue Shield has been experimenting with four data entry operators, called "cottage keyers," working out of their homes. They key health claims off-line, using portable terminals with a small amount of storage and transmitting periodically in batch to the central computer. They are paid a piece rate for each claim processed based on a quota of 1000 claims a week, roughly the equivalent of a full-time workload. The employees have part-time status and receive no fringe benefits.

The experiment was inspired by problems of high absenteeism and turnover and high error rates within the central data entry staff. In terms of productivity, management feels that the experiment has been a success; they cite shorter cycle times for claims processing and lower error rates for the cottage keyers than for the in-house staff. The original four participants are still on the job so

there has been virtually no turnover, and absenteeism is not an issue. The employees themselves are very satisfied with the work arrangement. They feel they make more money on the piece rate basis than they could with their former work arrangement, even when the lack of fringe benefits is taken into account.

Overall, management is very positive about the work-at-home program and is formulating plans to expand it to another clerical job, to be called "cottage coders."

o Mountain Bell

The Corporate Human Resources Division at Mountain Bell has been experimenting with "secondary work locations" for several years. Selected professional salaried employees work at home on a regular basis, on average three days a week. Some utilize sophisticated computer and communications equipment, while others require only pencil and paper for their work. The experiment is based on a management philosophy that trust is the foundation of a good working relationship between the employee and the organization. This trust is established by demonstrating fair and equitable treatment of employees in all cases; in turn, having the employees' best interests at heart fosters their motivation and loyalty to the organization. All participants are volunteers and receive full salary and benefits. The option of having a secondary work location, whether it is the home or not, is considered a privilege and is rewarded as such.

o Insurance Company--Los Angeles, California

This company operated a large western regional office in downtown Los Angeles. In 1973, it was studying alternatives to continued occupation of their old building. After having a cost-benefit analysis of several alternatives performed (Nilles, et al, 1976), the company chose to relocate two of its divisions to two satellite offices in the San Fernando Valley.

From the above descriptions, it is evident that telecommuting is viable both from the employer's and employee's point of view, and that it in fact can take several forms: work-at-home, satellite work centers (where a single company relocates an entire branch or branches to a new location near a residential area), and neighborhood work centers (where several different companies may lease space and equipment in a single building close to a residential area; there are no known examples of this due to the complexity of the institutional arrangements involved). Further, several kinds of work are amenable to telecommuting: managerial, professional, or clerical, whether on a fully-salaried, part-time, piece-rate, or contract basis (Olson, 1981).

As the technology involved becomes more commonplace, a great deal more telecommuting is expected to occur. It is desirable to estimate the extent to which telecommuting does and will take place. Estimating future telecommuting, however, is a complex problem, for several reasons. For one thing, the timing of the acceptance of new

innovations is always difficult to predict. It is one thing to forecast that, say, 40% of all work trips will be substituted by telecommunications, and another thing to determine whether that will occur by 1985 or 2035. Also, it is easier to estimate substitutability, or what proportion of work trips could be reduced, than substitution, or how much they actually will be reduced. Not everyone who could substitute trips will, whether because of lack of knowledge, lack of resources, managerial reluctance, lack of incentive, or preference for making the trip (e.g., for social stimulation, change of pace, or removal from domestic distractions). Further, telecommuting is not a homogeneous concept, but may include numerous variations. For example, work-at-home may involve any of the following options: always working at home, working at home one or more days a week (regularly or irregularly), or working at home only part of the day (and then going to the office) to avoid travel during peak hours. Thus, knowing that person X is telecommuting could mean several very different things in terms of total travel reduced, peak-period travel reduction, and office and parking space requirements. Finally, estimates of substitution should account for long-term shifts in employment composition. Specifically, the transition from an industrial/manufacturing economic base to an information- and services-providing base means an increase (both relatively and absolutely) in precisely those kinds of occupations which are most amenable to telecommunications substitution, and a corresponding decrease (relative and absolute) in many occupations which are least amenable to substitution.

While telecommuting will undoubtedly become more widespread of its own accord, it is highly desirable from a regional planning standpoint to actively encourage it. In Southern California, it is not only desirable but obligatory. In October, 1982, the SCAG Executive Committee adopted the 1982 Revision of the Air Quality Management Plan (AQMP) for the South Coast Air Basin, an area containing the greater part of the SCAG region. A fundamental portion of the AQMP is a 12-element long-range plan which, if implemented by the year 2000, could enable the area to attain federally mandated ambient air standards. A principal strategy in this long-range plan to reduce emissions from motor vehicles is the use of telecommunications as a substitute for 12% of the work-related trips projected to be made in the year 2000. This 12% goal is compatible with estimates of substitutability and substitution of work trips appearing in the literature (e.g., Jones, 1973 and JALA Associates, 1983).

In view of the fixed AQMP goal, which carries with it a legally binding commitment to attempt its achievement, and in view of the difficulty described above of reliably estimating substitution, SCAG chose, as a preliminary approach, to treat a 12% substitution rate by 2000 for the region as given, and then to analyze the effect that reduction might have on the transportation system of the region. Whether or not "12% by 2000" is realistic, and how to help ensure its achievement, are two important matters which will be addressed as time goes on. For the time being, however, it is of interest simply to see what would happen if the goal were achieved. In the following subsection, results from the study of the transportation system impacts of 12% telecommunications substitution are presented.

3.2.2 Analyzing the Effect of Substitution on the Transportation System: Preliminary Results[1]

Travel behavior forecasting in the SCAG region is done through the conventional urban transportation planning system (UTPS) computer package. The package consists primarily of four sequential models of trip behavior: trip generation (how many trips are made, from each "analysis zone" (AZ) in the region), trip distribution (where those trips go, by AZ), mode choice (what mode is taken--percentage splits by origin-destination zone pair), and trip assignment (what route is taken, for each mode between each zone pair). The problem at hand is to incorporate telecommunications substitution into this set of models so that its final effect on the transportation system (by mode and by route) may be accounted for.

Telecommunications substitution fits logically into the UTPS travel behavior models in several different places. For example, it may reasonably be viewed as a trip generation choice; i.e., a decision whether to make the trip or stay at home and work, resulting in an overall reduction in the number of trips made by a given zone. Unfortunately, however, the relationship between the amount of reduction on the one hand, and the input variables to the trip generation model (auto ownership and dwelling unit type) on the other hand, is not clear. Thus, it would be difficult to know how to change the input variables to reflect the substitution effect.

Alternatively, telecommunications is frequently viewed conceptually as another mode; e.g., one can drive a car to work, rideshare to work, or "telecommute" to work. While it may be fruitful in the future to pursue incorporating telecommunications substitution into the mode choice model, it is again the case that the model, as it is currently formulated, would not adequately capture the choice between telecommuting and "other" modes.

It is easier to speculate on what trip destinations might experience the most reduction. Substitution will be greatest for trips to areas of high employment in the "information industries": insurance/financial/real estate, services, and government. Thus, the approach taken in this analysis is to reduce trips at the distribution stage, i.e., by zone of destination, based on the type of employment in each zone. The remaining trips can then be analyzed as usual with the mode choice and trip assignment models, with the final result being an

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1 The computer modeling reported on here was performed by the Data Management and Forecasting Section at SCAG, while the analysis of that output fell to members of the Multimodal Analysis, Highway Planning, and Transit Planning Sections. All other work embodied in this report was executed by the former TSM/Rideshare Section; continuing responsibility for telecommunications planning within the Transportation Planning Department lies with the Special Studies Section.

estimate of the effect on the transportation network of the reduction in trips.

Ideally, one would want detailed information on employment type by occupation for each AZ, so that it would be possible to judge what proportion of the employment in each zone would be likely to telecommute. Unfortunately, such detailed information is not available, so a simpler, more approximate procedure is necessary. For the purposes of this analysis, all AZs were partitioned into four categories. These categories are based on Development Guide definitions of centers, corridors, and the core, and on a judgmental assessment of concentrations of office employment. They are as follows, in order of decreasing expected trip reduction:

a. Los Angeles CBD and other concentrations of office employment;

b. level two centers not included above, the regional core, and corridors;

c. level three centers; and

d. elsewhere.

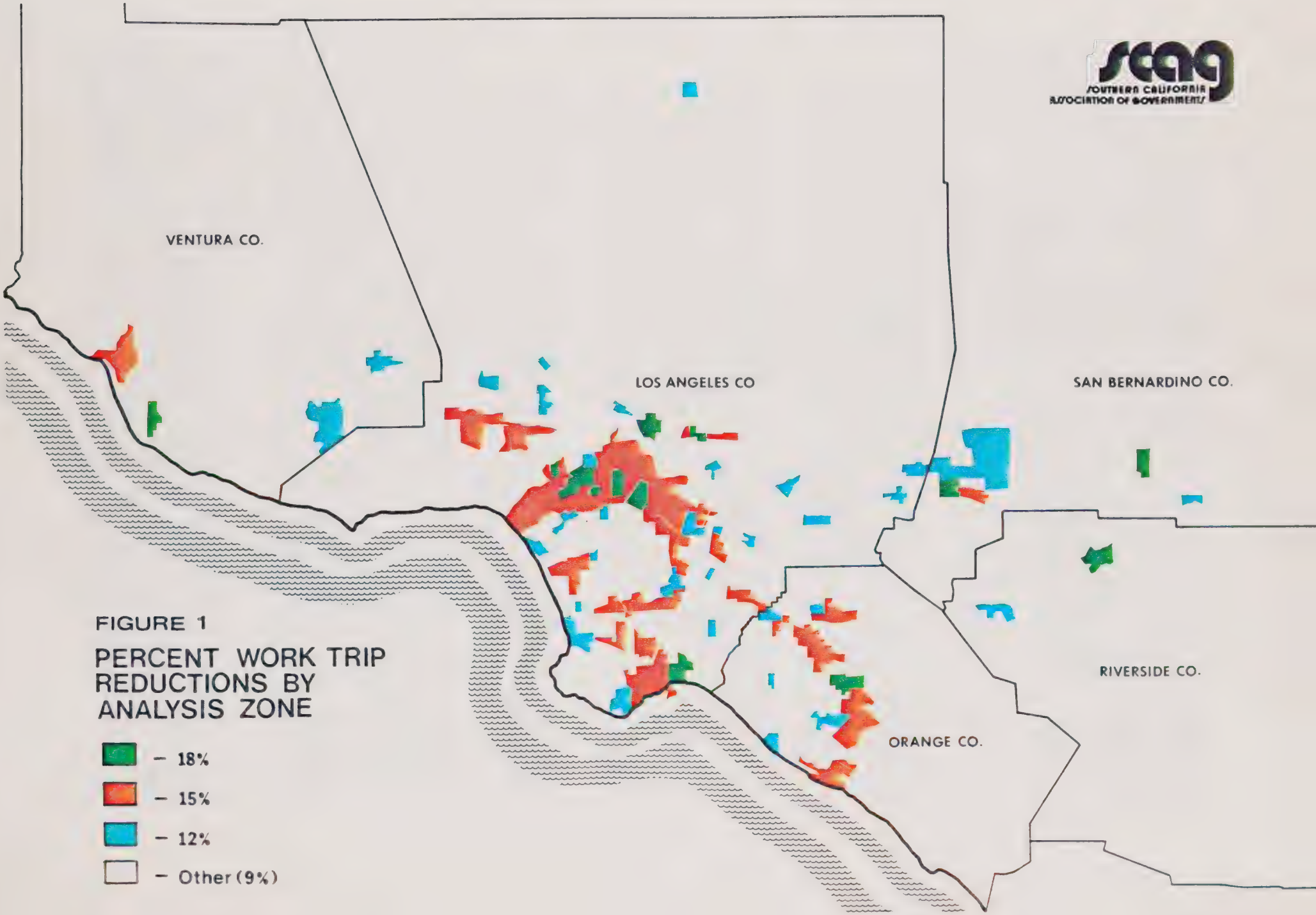
Estimates were made of the average trip reduction by category, in such a way that the overall number of trips reduced was about 12% of the total. There are many sets of estimates which result in a total of 12% reduction; Table 1 indicates one set which seems reasonable, and which was used in this analysis. In this particular scenario, zones in the four categories listed above were assumed to have trip reductions of 18%, 15%, 12%, and 9%, respectively. The AZs in each category are identified on the map in Figure 1.

TABLE 1

TELECOMMUNICATIONS SUBSTITUTION BY AZ CLASSIFICATION

Classification	No. of AZs	Total Work Trips*	% Reduction	No. Reduction
LA CBD	14	338,390	18	60,910.2
Office concentrations	39	1,027,181	18	184,892.6
Other level 2 centers	29	1,028,175	15	154,226.3
Core and corridors	136	2,314,578	15	347,186.7
Level 3 centers	54	1,245,111	12	149,413.3
	272	5,953,435		
Elsewhere	1013	7,535,863	9	678,227.7
Total	1285	13,489,298	11.7	1,574,856.7

* From SCAG 82A Forecast (year 2000), home-work plus other-work attractions.


VENTURA CO.
LOS ANGELES CO
SAN BERNARDINO CO.
RIVERSIDE CO.
ORANGE CO.
FIGURE 1
PERCENT WORK TRIP REDUCTIONS BY ANALYSIS ZONE
– 18%
– 15%
– 12%
– Other (9%)

After applying the appropriate reduction to each zone, the remaining trips were input to the mode choice and then trip assignment models. The outcome is an estimate of the number of vehicles on each segment of the highway network, and the number of passengers on each segment of the transit network. A number of summary statistics such as average delay per vehicle and total vehicle miles traveled (VMT) are also calculated. Table 2 presents some of these statistics for the year 2000 transportation system and demand ("1983 RTP" scenario) with and without telecommunications substitution.[2]

In comparing the figures in this table, it is important to keep in mind the assumptions underlying them:

- The models do not account for possible long-term shifts in land use (residential, employment and shopping location) and corresponding changes in the transportation system due to the widespread use of telecommunications. Rather, they represent the forecasting of conventional trends and accommodation of those trends on a specific transportation system assuming constant travel behavior patterns.

- For any single destination zone, the percent reduction due to telecommunications will vary with the origin zone. For example, if a destination were assumed to have reduced 15% of its trips overall, the reduction may be 20% from some origins and 10% from other origins. Time did not permit such an extensive evaluation of each destination zone, so trips were reduced at the same rate from each origin zone. This simplification may distort the actual (reduced) demand between zone pairs, and hence the final network assignments.

- Any model is an estimate of reality, and therefore, is subject to random error. Thus, two numbers which are "relatively" close may be viewed as statistically indistinguishable; substantive conclusions may be drawn only for "relatively" large differences.

From Table 2, it is seen that, with work trip substitution as specified in Table 1, mode shares change very little in absolute terms for work trips. The transit share declines slightly for home-work trips, and the passenger share decreases somewhat for other work trips. Both changes are plausible (those occupations and those travel corridors which have the highest potential for telecommuting may also be those occupations and corridors which normally use transit and rideshare proportionately more), but both are small in magnitude, and therefore not very reliable. Certain specific corridors may experience a

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2 The numbers in Table 1, and in particular the percentage reductions for each type of AZ, were based on a preliminary year 2000 forecast ("SCAG-82A"). When the UTPS models were run on the final forecast, the ultimate reduction due to telecommunications substitution was about 10.8% rather than the 11.7% indicated by Table 1. Thus, if the goal of 12% substitution is achieved, the effects on travel in the region will presumably be even more positive than Table 2 implies.

TABLE 2

THE EFFECT OF TELECOMMUNICATIONS SUBSTITUTION
ON YEAR 2000 VEHICULAR TRAVEL CHARACTERISTICS
SCAG URBANIZED AREA, AVERAGE WEEKDAY

	1983 RTP w/out telecom-munications	1983 RTP with telecom-munications	% Change
TRIPS (HOME-WORK)			
Person Trips	9,236,198	8,223,184	-11.0
Driver Share	79.5%	79.7%	.3
Passenger Share	11.4%	11.5%	.9
Transit Share	9.1%	8.8%	- 3.3
TRIPS (OTHER-WORK)			
Person Trips	4,341,630	3,882,147	-10.6
Driver Share	88.2%	88.6%	.5
Passenger Share	9.6%	9.1%	- 5.2
Transit Share	2.3%	2.3%	0.0
TRIPS (ALL PURPOSES)			
Person Trips	50,810,969	49,338,472	- 2.9%
Driver Share	68.9%	68.6%	- .4
Passenger Share	27.4%	27.8%	1.4
Transit Share	3.7%	3.6%	- 2.7
Average Freeway Speed Per Vehicle Trip (mph)			
A.M. Peak	31.00	36.00	16.1
P.M. Peak	31.00	33.00	6.5
A.M. Peak Average Vehicle Delay in Minutes	6.60	4.50	-31.8
Average Travel Time in Minutes	15.10	14.95	- 1.0
Overall Auto Occupancy	1.397	1.406	.6
Total Vehicle Miles Traveled	304,051,000	293,644,000	- 3.4
A.M. Peak	39,177,000	36,468,000	- 6.9
P.M. Peak	89,971,000	78,647,000	-12.6
Off-Peak	182,903,000	178,529,000	- 2.4
Total On-Road Motor Vehicle Fuel Consumption (millions of gals. per yr.)			
Gasoline	3,672	3,546	- 3.4
Diesel	857	846	- 1.3

	1983 RTP w/out telecom-munications	1983 RTP with telecom-munications	% Change
Tons Pollutant per Day from On-Road Motor Vehicles			
Reactive Organic Gases	319	305	- 4.3
Nitrogen Oxides	474	465	- 1.9
Sulfur Oxides	41	40	- 2.4
Total Suspended Particulates	95	92	- 3.2
Carbon Monoxide	3,352	3,208	- 4.3
Miles of Congested Freeways	118	80	-32.2

Sources: SCAG; Travel Forecast Summaries; Year 2000 with 2000 Systems (1983 RTP with and without Telecommunications); Technical Memorandum No. 3/FM/8301.04; March 18, 1983.

SCAG; Draft Environmental Impact Report, Regional Transportation Plan; Tables IV-3 and IV-7.

Note: A.M. Peak (6:30-8:30); P.M. Peak (3:00-6:00).

significant shift in mode split, however; this should be examined in a thorough study of the effects of telecommuting on the regionwide transportation system.

As for the overall trip statistics shown in Table 2, it is seen that overall person-trips decrease by about 3%. Overall mode shares, again, change only slightly. Average peak period freeway speeds increase in both a.m. (16.1%) and p.m. (6.5%) peaks with telecommunications substitution. Average delay per vehicle in the a.m. peak decreases markedly (31.8%) with telecommunications, from 6.6 minutes to 4.5 minutes. Total VMT decreases 3.4% with telecommunications substitution, with the largest decrease (12.6%) falling in the p.m. peak. Comparably, fuel consumption and emissions are reduced 2-4%. Finally, the number of miles of severely congested freeways drops dramatically (32.2%) with telecommunications, from 118 to 80 miles (a segment is defined to be severely congested if volume exceeds capacity by more than 25%). These reductions are described in Table 3.

The general conclusion which may be drawn from these observations is that telecommunications substitution has the potential to significantly improve conditions on the regionwide transportation system. This encouraging preliminary assessment provides justification and impetus for a more detailed analysis of the effects of telecommunications. In the following section, this and other future telecommunications planning work at SCAG are discussed.

4. Future Telecommunications Planning Possibilities at SCAG

To recapitulate, it has been argued that telecommunications is of importance to regional planning on two counts: as an effective means of communications per se, and as a means of substituting for travel. While work at SCAG in the first fiscal year of telecommunications planning has focused on the transportation-substitution aspect of telecommunications, the communications aspect is vital as well. Future work at SCAG will deal with telecommunications planning at both levels.

In the next fiscal year, SCAG's involvement in telecommunications planning will increase substantially. Possible major projects for next year include:

- Stage a demonstration teleconference, e.g., between Los Angeles and Sacramento, to illustrate the capabilities of telecommunications technology for the Transportation and Communications Committee and other interested parties.

- Sponsor or co-sponsor a workshop on cable (or telecommunications) issues for local governments in the SCAG region. Topics for such a workshop could include franchising and refranchising considerations, telecommunications management, programming for government/community access channels, interconnect possibilities, and regulatory issues. The Southern California Cable Association has expressed a strong interest in co-sponsoring this workshop with SCAG.

TABLE 3

IMPACT OF TELECOMMUNICATIONS ON CONGESTION RELATIVE TO THE 1983 RTP SYSTEM

FREEWAY	SEGMENT DESCRIPTION	REDUCTION[a] (MILES)	A.M. PEAK TRAFFIC DIRECTION
Ventura Freeway (101)	Between Las Virgenes Road and the San Diego Freeway (405)	5	Eastbound
Santa Ana Freeway (5)	Between the Garden Grove (22) and the Costa Mesa (55) Freeways	3	Northbound
	Between the Orange (57) and the Riverside (91) Freeways	5.5	Northbound
	Between the Long Beach (7) and the Santa Monica (10)/ Pomona (60) Freeways	3	Northbound
San Diego Freeway (405)	Between the Santa Monica (10) and the Marina (90) Freeways	3	Southbound
	Between the Century (105) and the Marina (90) Freeways	3	Southbound
	Between the Harbor (11) and the Long Beach (7) Freeways	2	Northbound
	Between the Orange (57) and the Costa Mesa (55) Freeways	2	Northbound
	Between the Santa Ana (5) and the Costa Mesa (55) Freeways	3	Northbound
Harbor Freeway (11)	Between the Santa Monica (10) and the Century (105) Freeways	2	Northbound
Orange Freeway (57)	Between the Pomona (60) and the Riverside (91) Freeways	3	Northbound
San Joaquin Hills Freeway (proposed)	Between State Route 133 and the Costa Mesa Freeway (55)	3.5	Northbound

Note: a -- Excludes freeway and expressway segments with less than 3 miles of congestion.

- Perform a study of the barriers to the interconnection of cable systems and strategies to remove those barriers. Several private entities have seriously analyzed the feasibility of interconnection within the region, and some are actively pursuing funding for implementation. Thus, SCAG's role may be to facilitate interaction between cable operators, interconnect entrepreneurs, and franchising authorities, while actively supporting the preservation of channel space for government and public access.

- Investigate case studies of existing work-at-home and neighborhood work center programs, identifying the advantages and disadvantages to employee and employer and evaluating the potential for wider applicability.

- Begin implementation of a pilot study of a work-at-home program at a high-potential area such as the Los Angeles central business district, the El Segundo aerospace employment complex, and/or at SCAG itself. The study would involve a preliminary survey of substitutability and an ongoing evaluation of the program.

In addition to these possible projects will be a continuous monitoring of the telecommunications literature, the status of cable franchises in the SCAG region, and legislation/regulations affecting telecommunications. Information acquired at SCAG (in both tangible and intangible forms) is available as a central resource for the region.

Possible activities in future years are numerous. Some have been touched on in the previous section, such as a comprehensive modeling effort to analyze the effects of telecommunications on transportation and land use in the future. Others are continuations or expansions of projects already begun, such as facilitating interconnects, and promoting work-at-home programs on a large scale (as ridesharing is now). Others are completely new projects which will arise as telecommunications technology and planning develops, such as inaugurating the use of an (interconnected) government access channel for public policy purposes, or initiating legislation on important telecommunications issues.

Leaving aside specific projects, the most important thing that needs to be done at SCAG for regional planning as well as in local governments throughout the SCAG region, is to begin development of a comprehensive, coherent telecommunications policy. At the local level, elements of such a policy might include:

- a commitment to universal, affordable telephone service,

- integration of telecommunications into the educational system,

- acquisition and effective use of advanced telecommunications technology in all departments of municipal government,

- encouragement of telecommuting, e.g., by instituting it for municipal employees where possible, by reducing parking requirements for developers/employers who have a telecommuting

program (as is now done in many places for ridesharing),

- motivation of cable operators to interconnect all contiguous cable systems,
- more effective use of governmental and educational access channels on cable systems,
- the provision of job training programs, quite possibly over cable,
- incorporation of a telecommunications element into the General Plan.

At the regional level, elements of a telecommunications policy could involve:

- active promotion of telecommuting as a means of reducing congestion and improving air quality,
- commitment to interconnection of all cable franchises in the region, with channel space available for governmental programming,
- support of a regional, switched broadband communications network for voice, video, and data transmission (whether through a cable interconnect, fiber optic phone lines, microwave, satellite, or combinations of technologies) to provide the infrastructure necessary to achieve telecommuting (and simply more effective communications) on a large scale,
- commitment to a Teleport (as is being developed in New York City) to provide the communications capability essential to the continued attractiveness of the SCAG region to new and established business (alleviating the problem of spectrum congestion with microwave transmission, and providing economies of scale due to collocation of similar services and businesses).

It is clear that the telecommunications revolution is here to stay. Accordingly, the commitment to regional telecommunications planning at SCAG is equally here to stay. The task is made both more difficult and more interesting because it is breaking new ground in regional planning. However, the imperative for coordinated regionwide planning is strong. The chance to ensure vital, effective communications within the region on a scale never before possible, and the chance to shape telecommunications-related trends for the good of the region, have arrived. With the plenteous resources available, the challenge of regional telecommunications planning can be faced with enthusiasm, optimism, and confidence.

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